What's New in Bitwig Studio 6.1

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Bitwig Studio v6.1 Features

One Sampler, All the Stops

- Joining our single and multisample options, **Sampler** now offers a *sliced* ***Sampler*** configuration, loading one audio file with various methods for triggering at points within the file.
- Root key is now an old way of thinking with new dynamic pitch detection and the *Analyzed Root Key* option.
- The new `Spectral` stretching mode is the product of modern advances and in-house DSP work.
- The new `Fragments` mode puts playful, versatile granular in your hands.
- The original `Repitch`, `Cycles`, and `Textures` play modes now offer various character options for a ton of new possibilities.
- You can now drag a sample – or samples – straight into a new **Sampler** device with various preset configurations.
- Plenty of other new workflows and sounds await in any flavor of **Sampler**.

Sliced Sampler, with new ideas

- When using a sliced **Sampler**, the blue *Slicing Start* and *Slicing End* markers determine the section of audio to be sliced.
    - These are analogous to *Single* mode's yellow *Play Start* and *Play End* markers.
- Like the single-file **Sampler** mode, the *Expanded Device View* duplicates the waveform/slicing interface, so you can have that larger (or popped-out) if needed.
- *Slicing Mode* options include:
    - `Divisions`, cutting the sample into a *Number of Equal Pieces* (default `8`, maximum `64`).
        - In this mode, every slice is the exact same length.
            - This can be nice when playing polyphonically with one of the looping *Playback Mode* options.
        - When working with pad triggers, setting the *Number of Equal Pieces* to the number of pads you have makes the entire sliced sample available.
    - `Beats`, to cut at a fixed *Beat Length of Each Slice* (default `16th note`, ranging for `Whole note` to `Triplet 32nd note`).
        - This mode uses and displays the detected BPM of the file.
            - By turning off the *Automatic BPM Detection* toggle, the file tempo can be set manually.
        - When set to an interval longer than eighth notes, gray subdivision lines will be shown on the waveform.
    - `Onsets`, to cut at the sample's transients.

    - An *Onset Sensitivity* control (default `100 %`, using all onsets) lets you remove weaker onsets.
    - A good choice for rhythmic material.
- `Pitch`, to cut at detected pitch changes.
    - When enabled, the sample is analyzed, and its detected pitch track is shown in orange.
    - A *Pitch Sensitivity* control (default `70 %`) adjusts the confidence, with a lower percentage resulting in fewer slices.
    - This can be nice for any monophonic material with pitch changes, such as a vocal line or bass parts where you want slices where the pitch changes.
- `Manual` mode, for defining your own slices.
    - Switching straight into this mode begins blank, with no slices.
- Manual slices can be added with any *Slicing Mode*, alongside computed slices:
    - Computed / mode-based slices appear yellow.
    - To add a manual slice: double-click in an unoccupied area. The manual slice will be a mint color.
    - To remove any existing slice: double-click it. This will work for computed (yellow) and manual (mint) slices.
        - Changing the slice mode's parameters will recreate computed slices that were deleted.
    - Holding [ALT] allows zooming on the waveform, so:
        - [ALT]-drag zooms the waveform in and out — and when zoomed in, pans the waveform.

        - [ALT]-double-click triggers the *Zoom to Fit* action.
    - To move any existing slice: drag the handle at the top of the slice. For a computed slice, this will convert it to a manual slice.
    - Manual slices will stay in place, even when you switch *Slicing Mode*.
        - To delete all manual slices: right-click the Sampler waveform and choose *Slices* > *Clear all manual slices*.
        - To commit all automatic slices: right-click the Sampler waveform and choose *Slices* > *Convert all Slices to Manual Slices*.
    - A good general workflow is starting with a computed slice mode, and then making manual adjustments as needed.
- Slices can be triggered by:
    - `All keys`, using black and white keys.
        - Offers the *First Slice Note* parameter (default `C1`), which sets the first note to assigned.
        - Will assign successive slices to the next MIDI key, until they run out.
    - `White keys`, skipping all black keys.
    - `Black keys`, skipping all white keys.
        - These modes also use the *First Slice Note* parameter, starting at that note or on the next matching note.
        - Both modes can quickly provide your desired layout.

    - In combination with the **Instrument Layer** device, you can access two sliced **Sampler** devices from one MIDI keyboard, etc.
    - In all three key-triggered modes, *Key Tracking* is disabled.
- `Velocity`, using note strength to select which slice is triggered.
    - By leaving note pitch free, you can still play across the keyboard with *Key Tracking* on to transpose each slice.
    - Each note played grabs a different piece of the sample, treating each slice like various 'articulations' to choose from.
    - The *Velocity Sensitivity* parameter (in the device's output section) still determines how much velocity messages affect volume.
- `"Select" parameter`, using the *Select* parameter value at note on to choose which slice is triggered.
    - By leaving note pitch and velocity free, you can freely play across the keyboard with *Key Tracking* to transpose each slice and *Velocity Sensitivity* to use velocity to affect volume.
    - *Select* can be controlled directly, via automation, or by any of Bitwig Studio's 40+ modulator devices.
    - This is the same *Select* parameter available when a multisample is loaded, similarly used there for selecting which zones to trigger.
- For all trigger modes (except `"Select" Parameter`), a note clip icon appears nearby that can be dragged into your project.

        - This generates a project-friendly clip that will trigger all slices in sequence with correct timing.
        - Sample parameters are taken into account, but device playback settings (such as *Speed*, etc. etc.) are not considered.
- *Playback Mode* options control how a triggered slice plays:
    - `to Slice end` will stop playback when the slice boundary is reached.
    - `to Sample end` will stop playback only when the *Slicing End* is reached.
        - For these non-looping modes, using the *One-shot* envelope will continue to the end. And using the *Gated* envelope will stop after the note is released.
    - `One-way looping` will jump to the opposite slice boundary and keep playing.
    - `Ping-pong looping` will reverse direction at slice boundaries and keep playing.
        - These looping modes require the *Gated* envelope, which will continue looping until after the note is released.
- *Zone/Slice Source* modulations are available, for customizing any slice.
    - Like in multisample mode, three modulation sources are available – **P**$_1$, **P**$_2$, **P**$_3$.
    - These polyphonic modulation sources can be mapped to any available **Sampler** parameter (or parameters of its nested devices and plug-ins).

        - When one of these sources is in modulation mapping mode, dragging across the waveform lets you set a value for any slice (it looks like a step sequencer).
            - Assigning modulations to a slice necessarily converts it to a manual slice.
- Slicing-related functions:
    - With a clip selected, *Slice / Fold > Slice to sliced Sampler* action lets you bounce the clip straight to a new sliced **Sampler** instance.
    - Right-clicking the device header of a sliced **Sampler** offers a *Convert to Drum Machine* option. This places:
        - Each slice into its own drum cell with its own **Sampler**.
        - If the **P** modulation sources were used for a slice, any targeted parameters are adjusted in that cell with the proper values (just as when they were modulated).
    - A sliced **Sampler** can be transformed into a multisample by right-clicking on the waveform and choosing *Conversions > Convert to multisample Sampler*.
        - This creates a multisample that responds the same way as it did before, taking the *Slice Mode* into account and all.
        - This allows, for example, converting two or more sliced **Sampler** instances, and then merging them into a single multisample **Sampler**.
- Like multisample configurations, sliced samples can be saved.
    - Right-click on a sliced **Sampler** waveform, and choose *Save to Library* from the context menu. A dialog will appear with name, creator, category, tags, and description options.

- These files are available from the browsers with the new *Sliced Audio* source.
    - In the **Browser Panel**, the *Samples + Clips* parent source includes *Sliced Audio* as one of its sources.
- Files are saved using the PreSonus AUDIOLOOP open format.

Root Key tracking, changing everything

- *Root key* is the traditional sampling concept of defining the single pitch of a sample, allowing proper playback/transposition.
- **Sampler**'s new *automatic pitch analysis* detects the pitch track of your sample, and apply it from the current playback position.
    - This is simply enabled by clicking the *Analyzed Root Key* option beside the *ROOT* label.
        - After analysis completes, the pitch track of your sample will be shown over the waveform as an orange curve.
        - The manual root key parameters are replaced by a *Dynamic* label.
    - On playback, the pitch of the sample (and, when appropriate, the playback speed) will now be known and compensated for each moment of the sample.
    - This means material that changes pitch can now just be played on the keyboard, regardless of how the material moves.

    - With root key becoming a dynamic concept, any musical material is suitable to be dropped onto a **Sampler**, particularly monophonic clips in your project.
- When *Analyzed Root Key* is disabled, the traditional *Root Key* and *Root Key Fine Tune* settings are available again.
    - The new pitch analysis can also be used to set a fixed root note.
    - Right-click the waveform, and from the *Sample Settings* menu, choose either:
        - *Set Root Key from Click Position*, or
        - *Set Root Key to Average Pitch*.

New Spectral mode, for sampler stretching, bending, and breaking

- Clean time stretching required a purpose-built algorithm.
- The new **Spectral** mode works for the clear cases, and can even full-stop to let you explore any sound.
- Two character modes are available:
    - `Pure` is meant for clean stretching.
        - When you toggle on *Formant Processing*, modulatable controls for *Formant* shift amount (±2 octaves) and *Formant Shift Amount* (a crossfade-type control) are active.
    - `Reharm` can also tweak your harmonics and reharmonize your sound.

        - A *Harmonic Bend* control lets you shift the harmonics of the sound (±2 octaves) while leaving the fundamental in place.
        - Harmonics can optionally be quantized, with three mode choices:
            - `Off`, where harmonics are not corrected
            - `to Octaves`, which shifts each harmonic toward the nearest octave
            - `to Global Key`, which shifts each harmonic toward the nearest Key step, using the project's *Root Note* and *Scale*
        - With that, a *Harmonic Quantize Amount* attenuates the amount of quantization being applied.
        - You can still toggle on *Formant Processing*, using preconfigured values.
- Both characters have a *Preserve Onsets* option.
    - This changes the playback speed thru onsets (basically, 'unstretching' them) to keep their original character.
    - The onsets are visualized on the waveform in orange.
    - The *Onset Sensitivity* control lets you filter to fewer, stronger onsets.
- Additional parameters are available in the **Inspector Panel**:
    - *Phase Dispersion* (default `66.7 %`) is the amount of phase randomization applied at extreme stretching ratios, effectively smoothing the sound. This parameter is also modulatable.
    - *Spectral Quality / Cost* (`Low`, `Medium` [the default], `High`, or `Ultra`) adjust the relative quality of pitch shifting and formant processing, as well as the processor and latency requirements.

- *Live Performance Mode* [default `On`] delivers notes without latency but with higher processor costs at note on. When disabled, latency is produced so that processing costs are spread out more evenly.

New Fragments mode, for grain clouds, microloops, and beyond

- Myriad options await in the new **Fragments** granular mode.
  - All of the main panel options are automatable and modulatable.
- *Grain Size* can be set either in time or as a beat unit (`16th note` default).
- Whatever the unit of *Grain Size*, *Grain Density* is set relative (`10` by default, ranging from `0.1` to `100`).
  - These parameters can be uncoupled as well, offering a *Grain Rate* control instead.
  - *Grain Rate* will follow the unit choice (time versus metronome interval) of *Grain Size*.
  - Additionally, the **Sampler** Grid module has a *Fragments Trigger In* port.
    - This mono port allows you to override the density/rate controls and create grains via signal input.
    - This can be particularly useful when you have an event sequencer or other synchronized signal you'd like to re-use.

    - Voice Stacking may be useful here, helping to overcome the limits of polyphony (which will only give you one active grain per voice).
- Like the **Textures** mode, a *Motion* control is available (from `0 %` to `800 %`), providing randomization for each grain's playhead as well as its stereo position.
- A *Grain Envelope* curve allows morphing the amplitude envelope of each grain, from a quick-attack pluck sound, to something more open and sustained.
- *Grain Repeats* (from `1` to `16`) sets the number of times that each grain is triggered.
    - The position of repeats is set by the *Repeat at Initial Position* toggle, in the **Inspector Panel**.
- Several additional grain-related parameters can be found in the **Inspector Panel**:
    - *Grain Playback Direction* offers several modes:
        - `Sample` always follows the set direction of the **Sampler** (forward or reverse).
        - `Playhead` (the default) uses the current playhead direction at the time each grain is born.
        - `Random` rolls the dice for each grain.
        - `Alternate` just uses the opposite direction of the previous grain.
    - *Latch Initial Rate* keeps the original rate of a grain for its entire lifetime.
    - *Grains Survive Voice End* reactivates the current grains (from their current playhead position) when the voice is triggered again. This can result in a smoother sound, for some purposes.

- *Maximum Grains per Voice* lets you limit the number of grains available to each voice.

Updated Repitch mode, now with characters of classic hardware

- **Repitch** has always offered traditional "tape machine-style" playback, where pitch and speed are coupled.
- Three character modes are now available:
  - `Clean` is for basic playback, like before.
    - The **Sampler** Grid module has now gained a *Repitch Phase In* port.
    - This allows you to perform phase modulation on any playing sample.
  - `Analog` does classic hardware warmth.
    - The Distortion parameter adds some *Crunch*.
      - Internal pre- and post-EQ stages mean the distortion is dependent on playback rate — and each note in a chord will get its own flavor.
    - The Color knob adds some stereo *Tape* saturation.
      - Positive settings push the high end, lower the mids, and flatten the transients (more room tone).
      - Negative settings push the low-mids, increase the tube feeling, and expand the transients (more POP).

- `Digital` brings polyphonic clocks for (mis)alignment choices.
  - The Distortion control adds some *Bits* reduction.
  - The *Color* control offers different flavors of sample-rate reduction, ranging from 90s hardware down to children's toys.
    - Positive settings make more "mistakes", with heavier aliasing and punching up the high-mids.
    - Negative settings are smoother and darker.
  - *Variable Sample Rate* [on by default] takes playback rate into account for sample rate changes, meaning each note gets its own sample rate.
  - *Digital Imaging Filter* adds a sample rate-dependent filter at the output stage (which is more proper and clean).
- The *Repitch Distortion* and *Repitch Color* parameters are shared between the `Analog` and `Digital` characters, making it easy to audition each mode while keeping any automation or modulation applied.

Updated Cycles mode, now with synthesis characters

- **Cycles** has always extracted single waveforms as pseudo wavetables, along with a *Formant* shifting option.
- In addition to this ever-present *Formant* control, **Cycles** now has three synthesis-heavy characters:

- `Pulse`, which supports pulse width-style modulation.
    - The bipolar *Width* parameter performs a positive or negative pulse-width modification.
    - Whether it's a slow LFO or anything else you'd try with PWM, you can now give some of that familiar sound to any sample.
- `Partials`, which lets you push the odd or even harmonics.
    - The bipolar *Split* control isolates odd harmonics (when negative) or even harmonics (when positive).
    - The *Fund(amental)* control inserts a sine wave at the played pitch, automatically following the voice's current level and blending with the rest of the sound.
- `Phase` modulation mode, which support PM/FM by a harmonic modulator.
    - The *Mod(ulation)* amount control represents the depth/ index of modulation from the dirty sine wave modulator applied to the sample.
    - The *Harm(onics)* control steps between various tunings for the modulator oscillator.
- For smoother sounds, any character can use the *Crossfade Two Voices* toggle.
    - This duophonic mode runs two **Cycles** voices instead of one and crossfades between them for a smoother sound (especially when *Analyzed Root Key* is enabled).
    - When this mode is enabled, the *Grain Size* parameters used by other modes appear for setting the crossfade time, either in seconds or beat units.

Textures mode, with light updates

- Our classic granular mode remains largely the same, with a few enhancements.
- As with `Fragments` (and `Cycles`), the *Grain Size* can now be set in beat units as well, which often makes the sound more musical immediately.
  - Since these parameters and *Motion* are shared with `Fragments`, auditioning the two modes is quite convenient, preserving your common settings – and their modulations – when you switch between the two play modes.
- The new *Analyzed Root Key* option can make a nice difference in **Textures**, feeding each grain with local pitch data.

Workflow Improvements

- Now you can drag one or more sample files straight onto a new or existing track to create preconfigured **Sampler** devices.
- When dragging one audio file to a track area:
  - Dragging normally will *Insert Sampler*, using your default preset.
  - [ALT]-drag will *Insert stretched Sampler*, putting the **Sampler** in `Spectral` stretching mode.
  - [CTRL]-drag ([CMD]-drag on Mac) will *Insert sliced Sampler*, putting the **Sampler** into sliced mode.
    - This also switches to the `One-shot` envelope mode, and puts the device in *Digi Mono* mode, which will choke playing slices when a new one is triggered.

- When dragging multiple audio files to a track area:
    - Dragging normally will *Insert round-robin Sampler*.
        - This loads all samples into one multisample, stretches the zones to cover all notes, and sets every zone to *Round-robin* mode so that each note triggers the next sample.
    - [ALT]-drag will *Insert Drum Machine*, loading your samples from pad C1 and up.
    - [CTRL]-drag ([CMD]-drag on Mac) will *Insert tuned Sampler*.
        - This loads all samples into one multisample, stretches the zones to cover all notes, and then sets the root note of each zone either from the filenames or by running the *Set Root Key to Average Pitch* function.
        - The result is a playable multisample.
- In a **Drum Machine** device where each cell only receives one note, some alternate choices are offered (*Insert layered Sampler* is like *Insert tuned Sampler* but without root key analysis), and other choices that don't make sense (*Insert sliced Sampler*) aren't offered.
- When dropping samples into empty areas of the Grid editor, **Sampler**-specific choices (*Insert round-robin Sampler*, *Insert layered Sampler*, and *Insert tuned Sampler*) are offered.
- When dragging one audio file to a part of your device chain where audio is expected (such as after an instrument, or into an *FX* chain), this will *Insert Convolution* and load it with your chosen sample.

Other Sampler Improvements & Changes

- *Use Project BPM* is available beside the *Speed* knob as a metronome icon.
  - The sample's tempo will be automatically detected, or can be set manually.
  - This toggle makes playback speed calculations include the project tempo.
  - When enabled, changing the project BPM will also change the playback speed of this **Sampler**.
- There are now three snap options when dragging visual handles on the waveform:
  - `No snapping` allows free editing.
  - `Snap to onsets` will snap only at detected onsets.
  - `Snap to zero crossings` will snap at every, well, zero crossing.
- New options for how to handle loops at note off.
  - When using one of the active LOOP modes (*One-way Looping* or *Ping-pong Looping*), three options are available for what to do *At Note Off*:
    - `Remain in loop` keeps the normal rules, constraining playback to the loop region during release.
    - `Continue freely` keeps playing from the current position, but will be free to pass the *Loop End* point.
    - `Exit loop immediately` will jump to the *Loop End* point at note off, letting you choose which section of the sample to play on release.

    - These choices are available in the LOOP menu.
- *Select* parameter can now dynamically change multisamples.
    - The *Select* parameter allows another dimension (together with key and velocity) for choosing which zones to trigger.
    - The new *Live "Select" Updating* option makes the *Select* parameter into a realtime control.
        - This requires a multisample with programmed *Select* value ranges (and *Select Fade* values for smooth transitions).
- For multisample editing:
    - Zones now have *Mute* and *Solo* toggles, which are nice while editing.
    - When multiple zones are selected, the **Inspector Panel** now offers standard Histogram editing for *Zone Parameter* values and other parameters.
        - By clicking the button at the right end of any of these values, the value range is visualized along with controls to shift the data's *Mean*, *Scale* their distribution, or inject some *Chaos*.
    - New zone actions are available to:
        - *Set Root Key to Average Pitch*, which uses the new pitch detection for determining the value.
        - *Distribute Key by Root Key*, which will take multiple selected zones and give them appropriate ranges based on their root keys.
- For the **Sampler** device, the filter has added an EQ-friendly *Bell* option.
    - Choosing this adds a *Bell Filter Gain* parameter (default `+6 dB`) for boosting or cutting most subtly.

- Since this is on the instrument, it is applied polyphonically where *Filter Keytrack* (and per-voice modulations) can make a big difference.

- The Grid **Sampler** module can also provide its analysis as signals…
  - The *Enable Analysis Out Ports* option (in the **Inspector Panel**) swaps out the **P_1**, **P_2**, **P_3** out ports for three others:
    - *Onset Out* (yellow), sending out a brief signal at the onset's intensity level when passed and zero when not at an onset.
      - As a hybrid trigger signal, this gives you the detected onset intensity so you can filter as you like.
    - *Pitch Out* (orange), outputting the analyzed pitch of the current playback position in Bitwig's standard pitch format.
    - *Envelope Out* (blue), outputting the analyzed amplitude of the current playback position.
  - All analysis out ports on this module are mono, and the values are output as each block (as is the analysis itself).
  - This could allow you to:
    - Trigger elements whenever onsets are passed in your sample.
    - Send the current pitch value of the sample to other modules (which can be polyphonic), or via the **CV Pitch Out** module to your hardware (probably better when mono).

        - Use the amplitude of each voice to shape other oscillators to correspond to the sample's current level on each voice.
        - Other unfathomable things.
- A few notes on changes to **Sampler**:
    - Some parameters that could previously be modulated or automated are no longer offered. This includes:
        - *Play Mode*
        - *Freeze Playhead*
    - The set parameter values will be loaded by **Sampler** in v6.1, but modulation/automation will be disregarded.
    - If you were modulating/automating these parameters, you can load your project in a previous version of Bitwig Studio and make any adjustments there.
        - Friendly reminder: Loading an old project in a new version of Bitwig Studio immediately backs up your old file (in your project folder's *auto-backups* folder, where a *version* folder is added).
    - Many other new toggles and mode switches are also not modulatable/automatable, as they trigger audio engine updates and kill active notes. This is by design.

New Tuner device, Grid module

- There is now a **Tuner** (Analysis) device.
- It visualizes:

    - The relative tuning of the current moment, as spokes that turn green when you approach in tune.
    - A text block displaying the current closest note, with cents offset above and frequency below.
    - A history chart of how "in tune" recent notes were. It can be helpful to both see performance history and display pitch envelopes of various instruments/patches.
- It has two parameters:
    - *Silence Threshold* (from -96.0 to 0.0 dB), setting the minimum level required for tuning.
    - *Reference Frequency (A3)* (from about 415 to 466 Hz; matching the range in **Micro-Pitch** [Note FX]), a frequency offset applied to the entire note range, set as the tuning for A3 (traditionally `440 Hz` and the default).
- The new **Tuner** (Display) Grid module offers the same options in a smaller footprint, so:
    - The text block is always shown.
    - Only one *Graph Style* is shown at a time (either `Present` or `History`). This can be changed by right-clicking the module, or from the **Inspector Panel**.
    - Both functional parameters are also in the **Inspector Panel**.

General Improvements

- Onset filtering functions thru out the program now use a "sensitivity" orientation:
    - A value of `100 %` means all onsets will be used.

    - This replaces the previous "threshold" orientation used in:
        - Various functions that could incorporate onset filtering, such as *Slice in Place* and *Quantize Audio*.
        - Audio events that make use of *Onset Sensitivity* (previously called *Onset Intensity Threshold*, and whose values have now been converted).
    - The *Intensity* value of onset events is unchanged.
- When dragging a clip within your project, the *Bounce* while dragging option is now mapped to [B], with additional source options of *Pre-FX* [1], *Pre-Fader* [2], or *Post-Fader* [3]
- Simple interface modulators now have their controls set to `100 %` when inserted, allowing you to start mapping immediately. These include:
    - **Button** (Interface)
    - **Buttons** (Interface)
    - **Macro** (Interface)
    - **Macro-4** (Interface)
- **Phase-4**, **Polysynth**, and **Sampler** (Synth) devices: Each device's filter keytracking option now has a default value of `100 %` when reset, such as by double-click.

Bitwig Studio v6.0 Features

Alias Clips

- *Alias clips* support sharing content across a single track.
- Note, audio, and automation clips each reference a pattern on that track.
- Clips that use the same *Pattern* are alias clips, marked with a little paper clip icon.
- When editing a *Pattern* in any clip, the *Pattern* is updated in all clips where it is used.
- Beside the clip's name and color in the **Inspector Panel** is a *Pattern* chooser, showing each *Pattern* available on that track, along with a visualization of its contents and the number of clips using it.
- Switching a clip to a different *Pattern* simply switches out the content being played back.
- The current pattern for the selected clip has a bright white frame around its square in the *Pattern* chooser.
- While the content, color, and clip name are shared, other parameters (such as each clip's start, length, looping, and more) remain independent.
- 'Unique' clips are the only ones using that particular pattern.
    - In the *Pattern* chooser, these unique clips show the fingerprint icon instead of a count.

- You can *Paste* [CTRL]-[V] ([CMD]-[V] on macOS) to create a unique clip, or *Paste as Alias* [CTRL]-[ALT]-[V] ([CMD]-[ALT]-[V] on macOS) to connect the clips' content.
- Similarly, [CTRL]-dragging ([ALT]-dragging on macOS) will *Copy* a clip, or [ALT]-drag ([CMD]-drag on macOS) to *Copy as Alias*.
    - Related, you can *Duplicate* [CTRL]-[D] ([CMD]-[D] on macOS) to create a unique clip, or *Duplicate as Alias* [CTRL]-[ALT]-[D] ([CMD]-[ALT]-[D] on macOS) as a way to create aliases.
- When capturing a Launcher performance into the Arranger, alias clips can be written to the Arranger with the *Record to Arranger as Alias Clips* option (in *Play* menu's *Clip Launcher* section).
    - The function can be pinned in the window (via the thumbtack icon).
- The *Make Unique* function duplicates the pattern for the selected clip, making it independent.
- The *Merge Duplicate Patterns* function removes matching patterns, turning any unique clips that were sharing identical content into alias clips.
- There is also a *Merge Duplicate Patterns for Project* function, for linking duplicate clips on any note track, audio track, and automation lane.
- The *Merge Duplicate Patterns* functions are great for:
    - Opening previous projects and immediately taking advantage of *alias clips*.
    - Working in your normal copy/duplicate way, and then linking duplicate material afterward.
    - And so on.

Automation Clips

- Record, edit, and create automation in meaningful, musical blocks.
- Use familiar clip workflows on automation, including content scaling/stretching (from functions or mouse interaction).
- Editing parent note/audio clip boundaries can affect automation clips as well, depending on:
  - The *Global Automation Behavior* [0], which toggles between `Follow` (green) to connect edits from the parent, and `Lock` (red) to keep the lanes independent.
    - This button resides in the transport, beside the *Restore Automation Control* [R].
    - Pressing [0] (zero) while dragging content will toggle the *Global Automation Behavior* and update previews immediately.
  - Each automation lane also has an optional setting for what to do *When parent is edited*, in case the lane should have its own fixed sense of lock or follow (see the following "Automation Editing" section for full details).
- Automation clips can also be directly edited at any time.
- Simply select an automation clip to then adjust, spread, or randomize its points together.
- Easily adjust note/audio clips and automation loops to use different lengths, etc. etc.
- In the Arranger, you are free to use track automation and/or automation clips.

- To turn track automation beneath a note/audio clip into an automation clip of the same length: [ALT]-click the lane above or below the automation curve to *Create Automation Clip*.
    - To make matching automation clips for all lanes, you can either[SHIFT]-[ALT]-click in any automation lane, or select the top-level note/audio clip, and then choose *Wrap Related Automation as Clips* [CTRL]-[G] ([CMD]-[G] on macOS).
    - If the parent note/audio clip was looping, *Create Automation Clip* ([ALT]-click) in an area with no automation will create a clip that loops as the parent note/audio clip does. But if automation is present in the area, the curve will be preserved by creating a full-length *Free Time* automation clip.
- To create an automation clip where there is no note/audio clip above: [ALT]-click in an Arranger lane above or below the automation curve. An automation clip will be created at the length of the current beat grid interval. Dragging to the left or right will elongate the clip by an additional grid length.
    - This also works with the Pencil tool.
    - [SHIFT]-[ALT]-click in any automation lane will *Create Automation Clips in All Lanes*.
- To turn a time selection of track automation into an automation clip: use the *Time > Wrap as Automation Clip* function, which is mapped like "group" to [CTRL]-[G] ([CMD-[G] on macOS).
- To turn an Arranger automation clip into track automation: use the *Clip > Flatten as Track Automation* function, which is mapped

like "ungroup" to [SHIFT]-[CTRL]-[G] ([SHIFT]-[CMD-[G] on macOS).

- Preferences are available for how Arranger automation is recorded in different context, in the **Dashboard** under *Settings* > *Recording* > *Arranger Parameter Recording*.
  - *When Note recording, create:* `Automation Clips` (the default, creating matching clips) or `Track Automation`.
  - *When Audio recording, create:* `Automation Clips` (the default, creating matching clips) or `Track Automation`
  - *When writing automation, create:* `Automation Clips` or `Track Automation` (the default).
- Automation clips on the Clip Launcher will follow their parent note/audio clip. So:
  - Automation clips can always be triggered (and stopped) directly.
  - Triggering a note/audio Launcher clip (including via *Next Action*) will also launch its automation clips.
  - When Launcher automation clips are below a normal, empty note/audio slot, a play button is available in the empty slot for triggering all automation clips beneath.
  - For scene launches:
    - For empty note/audio slots that have a stop button (a normal clip slot), automation clips below will fire.
      - Note: An empty note/audio slot with a stop button will display a convenient trigger to *Launch automation clips*, letting you trigger all automation clips at once.

        - For empty note/audio slots that do not have a stop button, automation clips below will not fire on scene launch. These automation clips must be launched manually.
    - Temporary actions (like ALT-trigger of clips or scenes) will take each playing clip's position on takeover and accordingly return on release.
    - Track stop messages will apply to its automation lanes too.
- Automation clips can be saved to your library.
    - `Automation` clips can be found alongside BWCURVE files.
    - Both can be loaded as automation clips, either by dragging them in to a clip lane/slot from the **Browser Panel**.
    - Clicking plus in an empty automation clip slot loads the visual curve browser, offering automation clips and BWCURVE files for insertion.
    - Dragging an automation clip from the current project into a device's Modulator Panel loads the shape into a **Segments** (Envelope) modulator – or [ALT]-drag to load the shape into a **Curves** (LFO) modulator.
        - The same is true for dragging an automation clip from the current project into a Grid device's Grid editor, loading the shape into a **Segments** (Envelope) module – or [ALT]-drag to load the shape into a **Curves** (LFO) module.
    - Dragging an automation clip from the current project onto any curve-based device simply replaces the device's loaded content with the curve.

- Automation clips also have a *Free Time* toggle, for cases where their internal timing differs from their parent note/audio clips:
    - When enabled, edits of a parent note/audio clip's loop parameters, etc., will not affect the automation clip.
        - The little running man icon is shown on the top right of the automation clip header (and within the loop control bar in the header of the **Detail Editor Panel** in `Clip` context).
    - When disabled (the default), inherited clip Inspector parameters are shown but appear dim, including:
        - *Looping* enable, *Start* time, and *Length*
        - Clip *Offset* (for Arranger clips)
        - Clip *Start* and *Stop* times (for Launcher clips)
    - This toggle will automatically be turned on in certain cases, such as:
        - Editing one of these parameters so they don't match the parent note/audio clip anymore.
        - Dragging either a note/audio clip or an automation clip to a place where it doesn't match its new partner.
        - Recording automation in a different looping pattern.
        - Selecting a looping Arranger clip with track automation beneath, and using the *Wrap Related Automation as Clips* function (which creates a full-length clip without changing the playing automation).
            - To create automation clips that mask the content with the parent's looping window, you can [ALT]-click any track automation lane to *Create*

Automation Clip (or [SHIFT]-[ALT]-click to *Create Automation Clips in All Lanes*).

- For pre-v6 projects, automation lanes within note/audio clips that had *Free Run* enabled will enable *Free Time*.

- You can also use *alias clips* to link automation patterns across an automation lane, both in the Arranger and in various Launcher slots.
- Automation clips can be used:
  - As an arrangement unit, either for repeating directly or reusing in other sections (including as *alias clips*).
  - As a performance gesture.
  - As a selection group, so that one click selects a block of points that can be edited together.
  - Etc. etc.

Automation Editing

- There are two new ways to access automation.
  - A new *Automation Mode* is available in the Arranger:
    - This mode keeps the current track layout of the **Arranger Timeline Panel**, and then transforms their clips to an "x-ray" style and overlays one automating onto each track.
    - Enable/disable it either by clicking the filled *Automation Mode* button (up by the Launcher and Arranger toggles), or by simply pressing [A].

        - The lane has a "flying" behavior, following the parameter you last touched automatically, or any other single lane you choose.
        - From the *Mixer* level of any track, each entry (such as *Volume*) ends with an asterisk icon [`*`]. Selecting this icon points all available tracks to that same mixer parameter.
    - Any/all automations lanes can now be edited in the **Detail Editor Panel**:
        - Selecting an automation clip (or a point within it) on the Arranger loads it directly. Or when a parent note/audio clip is open, switching to the *Automation Editor* shows all coincident automation clips.
        - From the *Track* context mode, the *Automation Editor* will show all automation clips and Arranger automation lanes together.
            - When the **Detail Editor Panel** is in `Track` view, selecting any track automation point on the Arranger will focus the editor panel on that automation lane.
    - Both new modes can keep the Arranger as you had it, or just give you a new perspective on how different tracks relate to one another.
- You can still unfold all automation lanes for any track in the Arranger.
    - When hovering any Arranger track header, the bottom of the track's color stripe will show various icons:

        - A plus sign [+] is shown when no automation is present. Clicking the plus offers the menu to add an automation lane.
        - A greater-than chevron [>] is shown when track automation is present but folded away. Clicking the chevron unfolds all automation lanes for this track.
        - A downward-facing chevron [v] is shown when track automation is present and visible. Clicking the chevron folds up all automation lanes.
    - When not hovering, tracks that have hidden automation show a blended circle, hinting that this is a clickable area.
    - For any track selected, [SHIFT]-[A] toggles between showing and hiding all automation for that track.
    - Lanes can get smaller now, fitting more on screen.
        - When lanes are too small for point selection and editing, only the curve is shown. Other, meaningful gestures — like Pencil and Spray Can drawing, Time Selection gestures, segment adjustments (for track automation), and *Slide Content* (for automation clips) — are still available (see just below for details).
        - The Arranger's new *Auto-zoom* [SHIFT]-[Z] option (details below) is a good compliment when working with small lanes.
- When automation lanes are unfolded, the last clicked parameter can be previewed for immediately creating automation via the *Flying Automation Lane*:

- A button to *Toggle Flying Automation Lane* [SHIFT]-[ALT]-[A] is beside the *Automation Mode* [A] button (above the Arranger track headers).
- When enabled, any track (with its automation lanes unfolded) offers a preview lane for the last parameter touched, so you can directly insert or draw automation.
- For new projects, *Toggle Flying Automation Lane* is on by default.
- This doesn't affect *Automation Mode*, where each track is overlayed with its own "flying" lane.

- Wherever you work with automation, editing workflows have been greatly improved:
  - Automation points can be freely dragged, even past other points.
  - Clicking just off the curve drags the nearest two-point segment.
  - [SHIFT]-[CMD]-dragging moves an entire automation curve up and down.
  - With the Time Selection tool, various editing functions are available with [ALT]-drag to move points up and down:
    - [ALT]-drag in the center will *Offset Time Range*, moving only the time selection.
    - [ALT]-drag from the top to *Scale from Maximum*, preserving the minimum value.
    - [ALT]-drag from the bottom to *Scale from Minimum*, preserving the maximum value.
    - [ALT]-drag on the left edge to *Shear Start of Time Range*, bending the start of any time range.

        - [ALT]-drag on the right edge to *Shear End of Time Range*, bending the end of any time range.
        - These functions are also available when working with expressions in both the *Waveform Editor* and the *Drum/Hybrid* Editor.
    - The Pencil tool transforms shapes you draw into accurate, simple curves.
    - The Spray Can tool draws stepped automation at the current beat grid interval (read: techno).
        - [ALT]-drag with Spray Can to create a longer held automation point, good for creating alternating rhythms.
    - After any edits, high-fidelity thinning is applied.
- New features are also available for all automation points:
    - Each point can have *Hold* behavior, staying at the current value until the next point is reached.
        - With automation points selected, you can *Toggle Hold* [H] to switch their states.
    - Each point can have randomized *Spread*, setting a range where the point will land on each pass.
        - *Spread* can be set from the Inspector, or by [CTRL]-[ALT]-dragging ([CMD]-[ALT]-dragging on macOS) up and down on a selected point.
        - For reproducible *Spread* results, automation clips have a *Seed* setting, as do automation lanes (for Arranger automation).
    - Each point's *Curvature* (the slope on the way to the next point) is now shown in the Inspector.
        - This allows text entry for precise values.

        - When multiple points are selected, this allows for group editing of the values, including use of the **Histogram** interface (with its *Mean*, *Scale*, and *Chaos* controls).
    - Polyphonic event expressions and automation both have these new features.
- Each automation lane now has four states for what to do *When parent is edited:*
    - `Use editor setting` - Trusts the *Global Automation Behavior* [`0`], shown in the transport area.
    - `Always follow` - Note/audio/global time edits are applied to this lane.
        - This option keeps lanes connected to track/global edits in all cases.
        - New MIDI automation lanes default to this value.
    - `Never follow` - Protect this lane from note/audio/global time edits.
    - `Arranger lock` - Protect this lane on the Arranger. (The Launcher trusts the *Global Automation Behavior*.)
    - Icons are displayed on any lane header that is set to `Always follow` (◂▸), `Never follow` (🔒), or `Arranger lock` (an icon combining a padlock with the Arranger icon).
- Selection previews have also been improved:
    - When automation lanes are shown, automation lanes selected via a note/audio/global time selection are highlighted as well.
    - When a note/audio clip is selected, the bottom right edge of the clip shows a badge with the number of automation lane (on the Arranger) or number of automation clips present (in the Launcher) that are also selected.

        - The number is shown brightly when *Global Automation Behavior* is set to `Follow`, and more dim when *Global Automation Behavior* is set to `Lock`.
    - These badges are always shown when clips are selected, including when automation lanes are folded away, and in the **Mixer** view.
- Automation recording is also simplified & improved:
    - To record automation while a note/audio clip is playing back, enable the *Automation Write* button.
        - During playback, you can simply click this button to capture incoming automation without affecting note/audio data.
        - There is now only one *Automation Write* button, which applies to both the Arranger and the Launcher.
        - *Automation Write* is pinned by default, and located in the *Automation* section of the *Play* menu.
        - *Automation Write* now supports recording Launcher automation clips at different lengths from the original note/audio clip.
    - General automation recording has been overhauled with several structural improvements.
        - Delay compensation for recording has been improved, no longer being affected by latency of other tracks and with improved timing precision.
        - Arranger automation recording within the active Arranger loop writes your entire performance into the clip, and then sets the clip start time appropriately when finished.

        - Punch-In and Punch-Out now limit Arranger recording for both note/audio clips, as well as for automation recording.
            - Interacting with either button no longer starts recording.
            - Additional visual feedback is offered on the Arranger Loop Selector.
    - Automation is automatically recorded when note/audio clips are being recorded.
        - This is controlled by two settings, under **Dashboard** > *Settings* > *Recording* > *Recording*.
        - *Write automation when recording Arranger clips* automatically enables the *Automation Write* button when the global record is active.
        - *Write automation when recording Launcher clips* will also capture automation on any slot where audio or note/CC recording is triggered.
        - Both settings are on by default.

Key Signature Support

- The key can be defined for your project, set by the twin *Root Note* and *Scale* parameters.
- 23 *Scale* choices are available, including:
    - Classic modes:
        - `Major` (Ionian)
        - `Minor` (Aeolian)

        - `Dorian`
        - `Phrygian`
        - `Mixolydian`
        - `Locrian`
    - Compositional scales, in major–minor pairs:
        - `Harmonic Major`
        - `Harmonic Minor`
        - `Overtone Scale`
        - `Jazz Minor` (the descending scale for melodic minor)
        - `Blues Major` [6 notes]
        - `Blues Minor` [6 notes]
        - `Double Harmonic Major`
        - `Double Harmonic Minor`
    - Alternate patterns:
        - `Whole Tone` [6 notes]
        - `Half-diminished` [7 notes]
        - `Diminished WH` [8 notes] (whole-, then half-steps, alternating)
        - `Diminished HW` [8 notes] (half-, then whole-steps, alternating)
        - `Major Pentatonic` [5 notes]
        - `Minor Pentatonic` [5 notes]
        - `Major Triad` [3 notes]
        - `Minor Triad` [3 notes]
- The *Piano Roll Editor* can *Snap to Key*, by clicking the sharp–flat icon or pressing [K]. When active:
    - The Pencil and Spray Can tools will only preview and create in-key notes.

    - The arrow up and down keys will nudge by scale degrees (instead of half steps).
    - The note background can either `Adapt to Key` (using colored lanes for in-key notes and dark lanes for 'out' notes), or to show the traditional `Piano Pattern` of white/black keys.
- When notes or clips are selected, the *Transpose > Quantize to Key* function will push all notes into the current key.
- Six note FX devices have an option to *Use Global Key* (by clicking the same sharp–flat button in their device header), allowing the current global key to affect note transposition:
    - The **Arpeggiator** device's per-step *Transposition* parameters will switch from semitones to scale degrees when *Use Global Key* is enabled.
    - The **Echo** device's *Feedback Transpose* parameter will switch from semitones to scale degrees when *Use Global Key* is enabled.
    - The **Multi-note** device's *Pitch Offset* parameters will switch from semitones to scale degrees when *Use Global Key* is enabled. (The *Learn Chord* function is also disabled in this mode.)
    - The **Note Transpose** device's *Semitone Shift* parameter is swapped out for a *Step Shift* parameter when *Use Global Key* is enabled.
    - If the **Randomize** device's *Pitch Randomize* function is enabled in the *Quanitized* mode (to land on exact semitone steps), enabling the *Use Global Key* will randomize by the set number of scale degrees.

- The new **Key Filter+** device includes the 23 global scales. The device has *Local Key* and *Local Mode/Scale* parameters, or it will follow the project when *Use Global Key* is enabled.
  - *Pitch Offset* defines how many scale steps to move notes.
  - The *Foreign Note Handling* parameter sets how to handle out-of-key notes:
    - `Filter` removes foreign notes, only passing "in" notes.
    - `Keep` preserves foreign notes as played (only applying *Pitch Offset* to "in" notes).
    - `Constrain` corrects foreign notes to current scale, based on the *Constrain Mode* Inspector setting:
      - `Quantize Up` corrects foreign notes up to the next "in" note.
        - `Smart Quantize` makes a musical, scale-specific choice for which foreign notes should go up and which should go down.
        - `Quantize Down` corrects foreign notes down to the next "in" note.
    - `Solo` only outputs the foreign notes (with no *Pitch Offset* applied).
  - The original **Key Filter** device is now in legacy status. It will still load and work when requested, and you can

right-click in the device header to *Upgrade to Key Filter+*.

- When *Use Global Key* is enabled with **Arpeggiator**, **Echo**, **Multi-note**, **Note Transpose**, or **Randomize**, a pitch shift of `0` (zero) scale degrees passes thru whatever note came in (including out-of-key pitches). When pitch shift is enabled, notes are corrected with the same `Smart Constrain` logic as **Key Filter+**.
- When *Use Global Key* is enabled, relevant parameters or labels are tinted blue (and unused parameters appear disabled).

- Four new Grid modules, three of which use the current global key signature:
  - **by Scale** (Pitch) corrects incoming signals to land on pitches within the current key, with a definable *Constrain Mode* Inspector setting.
  - **Scale Steps** (Pitch) shifts incoming signals by a set number of scale degrees, with a definable *Constrain Mode* Inspector setting.
  - **Root Key** (I/O) provides the root note of the current global key signature, formatting it as a pitch within a set *MIDI Octave* and with optional octave wrapping.
    - New **Pitch Class** (Pitch) Grid module: Manually controlled constant module, offering the 12 pitches and using the same *MIDI Octave* and optional octave wrapping options as **Root Key**.
- Both *Root Note* and *Scale* parameters have transport lanes, which can be automated from the Arranger or by Launcher clips.

- Both *Root Note* and *Scale* parameters can be added to project remote controls, or controlled by modulators from the master track.

Editing Improvements

- The **Detail Editor Panel** now offers note, audio, and automation editing, both of single clips, whole Arranger tracks, or any layered combination based on your current selection. (The dedicated **Automation Editor Panel** has been removed.)
  - The fullscreen **Edit View** ([SHIFT]-[TAB]) offers the same **Detail Editor Panel** functionality, putting clip- or track-based editing into the center of your screen.
  - In either panel, you can press [F] to toggle to the following available editor and cycle thru them all.
- Both the **Detail Editor Panel** and the **Arranger Timeline Panel** have been generally improved, both visually and for streamlined workflows.
  - All available editing tools appear on the right top edge of each panel.
    - Right-clicking within the full palette area shows a menu with all tool icons, names, and their assigned shortcuts:
      - `Pointer tool` [1], for object selection and general editing.
      - `Time Selection tool` [2], for time selection and navigation.
      - `Pencil tool` [3], for inserting events and drawing points.

        - `Spray Can tool` [4], for inserting multiple events (more info).
        - `Knife tool` [5], for cutting events once or at intervals.
        - `Eraser tool` [6], for erasing events or time regions.
        - `Audition tool` [7], for previewing events in isolation (more info).
        - `Step Input tool` [8], for entering individual notes and chords via MIDI in the Detail Editor Panel (more info).
    - A short press of any shortcut switches to that tool.
    - Holding the shortcut will temporarily switch to that tool, returning to the previous tool when the key is released.
    - When the panel is resized to be shorter, only the active tool is shown, which can be clicked to switch tools via menu.
- The bottom-right corner has a "control panel" icon. When clicked, an *Editor Settings* menu appears.
    - This includes the *Timeline Snapping* options and *Beat Grid* settings.
    - Interactive *Appearance* settings relevant to the current panel are also available:
        - *Dark Grid Lines*paints black beat grid lines when enabled (the default), or white lines when disabled.
        - *Grid Intensity* adjusts the opacity of the beat grid lines, with `0` hiding the lines altogether.

        - Note that beat grid lines appear sharp when an editor's *Time Snapping* is enabled, and slightly blurry when *Time Snapping* is disabled.
      - *Timeline Background Level* adjusts the brightness of empty timeline areas.
    - At the top are editing specifics, such as the current tool for this panel, and editing-specific preferences when in the Arranger (such as whether the *Pointer tool supports Time Selection*, when mousing below the clip header), for note editing (such as the *Color Notes by:* option [like `Pitch Class` or `Velocity`] and the *Insert Channel* for new notes), and so on.
    - Several toggle controls that have icons on the editor itself are also listed here, for textual clarity and to display assigned shortcut keys.
- The **Arranger Timeline Panel** now has an *Auto-zoom* [SHIFT]-[Z] option (also available by clicking the braced ↕ icon in the lower left).
  - When enabled, the selected track or automation lane will change to the zoom size.
  - To change the zoom size, simply resize the currently auto-zoomed track/lane.
  - Selection is easiest done by clicking a track or lane header.
- The **Detail Editor Panel** always shows a top-level switch for the editing context:
  - `Clip` editing shows the full clip contents with the clip's timeline. Headers are available for adjusting the *Start* position, *Stop* position (when not looping), and a loop control bar (double-

click to toggle *Looping*, drag or edge-drag to adjust the looping region). And when working with a single clip, any events outside of the current clip bounds are also shown.

    - `Track` editing shows the current Arranger contents with the project's timeline. Each clip shows an interactive header, allowing you to select (click), move (drag), change the length (edge drag), or stretch ([ALT]-edge drag) any clip.
        - When working with the Clip Launcher, the `Track` context is not available.

- **Detail Editor Panel**: The last ten editor states are now remembered and can be navigated:
    - Once multiple selections have been made in the open project, a back arrow is now shown in bottom left corner of the **Detail Editor Panel**.
    - Clicking this arrow will *Navigate to Previous Editor Content*.
    - Holding [ALT] flips the arrow to a forward arrow, allowing you to *Navigate to Next Editor Content* (if you had navigated backwards already).
        - Both actions can be assigned keyboard or controller shortcuts (from the **Dashboard** under *Settings* > *Shortcuts*).
    - Each time the clip selection is changed in the Arranger / Launcher, and toggles between the *Clip* and *Track* contexts are stored as individual events.
    - This works both in the **Detail Editor Panel** and its fullscreen **Edit View**.
        - This allows you to switch between recent content without leaving the editor.

    - It can be particularly useful for restoring a layered selection of clips/tracks after doing edits on the Arranger, etc.

Drum/Hybrid Editor revamp

- The *Drum/Hybrid Editor* (previously the *Drum Editor*) has received significant improvements.
- The lanes now automatically resize to fit everything on the screen, when possible. (Small lanes can also be zoomed in, when desired.)
- It is now possible to see notes and audio side-by-side in this editor, with a combination of lanes for individual notes and audio.
    - When working in `Track` context, selecting a note or audio clip on a hybrid track will default to the *Drum/Hybrid Editor*.
- *Pitch / Transpose*, *Velocity*, and other expressions can be viewed on top of events with the *Expression Overlay* [X] mode (explained below).
    - Using the *Expression Overlay* mode with notes in the Drum/Hybrid editor supports drawing with the Pencil and Spray Can tools as well.
    - When working with *Pitch / Transpose* [P] (or *Formant*), right-clicking on the vertical axis offers a pop-up menu with a couple of settings:
        - *View Range* sets the visible semitone range, for comfortable editing in different situations. Options include `±1` (one half-step up and down), `±7` (a perfect fifth up and down), `±12` (one octave up and down; the default), `±24` (two octaves up and down), etc.

    - *Snap to semitones*, when on (the default), will make vertical edits stick to each nearby semitone.
        - When *Snap to semitones* is on, holding [CTRL]-drag ([CMD]-drag on macOS) temporarily disables snapping.

Note Editing updates

- The left top edge allows switching between the *Piano Roll Editor* (showing all notes) and the *Drum/Hybrid Editor* (showing only used notes — or if a **Drum Machine** device or similar plug-in is present, all notes with active chains).
- Whenever using the *Piano Roll Editor*, an option to *Show Audio in Background* is available, using any track containing audio as a background reference for note editing.
    - Clicking on the *Show Audio in Background* button toggles the function on and off.
    - Long-clicking or right-clicking on the *Show Audio in Background* button offers a menu for selecting which audio-containing track to display in the background.
    - By default, the first audio-containing track in your project will be selected.
- On hover, the Pencil and Spray Can tools previews the note that will be created if you click.
- The Spray Can tool creates a row of notes at the current beat grid interval (read: hi-hats), using vertical mouse position for the velocity of all notes.

    - Holding [ALT] with the Spray Can tool works the same, except dragging the mouse vertically moves the current step to a different note (read: step sequencing).
- The Knife tool can be dragged over various notes. When the mouse is released, all events will be cut in the same place.
- The Eraser tool can be dragged freely to delete any note passed over.
- The *Note Expression Lane* [V] below can show any single expression (including *Velocity*, *Chance*, and *Release Velocity*).
- A new *Expression Overlay* mode allows viewing and editing any continuous expression on top of note events.
    - Clicking on the *Expression Overlay* button (or pressing [X]) toggles between viewing the current expression or editing it (visualizing notes in an "x-ray" style with expression curves on top).
    - Long-clicking or right-clicking on the *Expression Overlay* button offers a menu for switching from *Pitch / Transpose* [P] to *Gain* [G] or other expressions.
    - In the *Drum/Hybrid Editor*, non-continuous expressions (*Velocity*, *Release Velocity*, and *Chance*) can also be edited as overlays.
- The *Edit by MIDI Channel* icon is bright and available for clips containing multiple channels (or the icon is dim and available for adding channel diversity to an existing clip).
    - By default, notes are colored by *Channel* in this mode.

Audio Editing updates

- The *Waveform Editor* allows working with audio events, including:
  - Fade/crossfade handles at the top left and right of each event.
  - Gain adjustment by dragging up and down at the top of each event.
  - Content slide by dragging left or right at the bottom of each event.
- The *Comping Editor* icon is bright and available for clips containing take lanes.
  - When no take lanes are present, the icon is dim but still available, in case you want to add take lanes to an existing clip.
- When using the *Waveform Editor*, the *Expression Overlay* mode [X] allows toggles viewing and editing of expression data on top of their associated audio events.
  - Clicking on the *Expression Overlay* button adds the selected expressions on top of the between viewing the current expression or editing it (visualizing notes in an "x-ray" style with expression curves on top).
  - Long-clicking or right-clicking on the *Expression Overlay* button offers a menu for switching from *Stretch* markers to a different expression.
  - When working with *Transpose* [T] (or *Formant*), right-clicking on the vertical axis offers a pop-up menu with a couple of settings:
    - *View Range* sets the visible semitone range, for comfortable editing in different situations. Options include ±1 (one half-step up and down), ±7 (a perfect

fifth up and down), `±12` (one octave up and down; the default), `±24` (two octaves up and down), etc.

- *Snap to semitones*, when on (the default), will make vertical edits stick to each nearby semitone.
    - When *Snap to semitones* is on, holding [CTRL]-drag ([CMD]-drag on macOS) temporarily disables snapping.

- Audio- and fade-editing has been refined, both on the **Arranger Timeline Panel** (for clips) and in the **Detail Editor Panel** (for audio events as well):
    - Fade edit handles are now more consistently available across the fade area.
    - Editing the curvature of a fade now requires [ALT]-dragging on the fade area.
    - In the *Waveform Editor* (within the **Detail Editor Panel**), event boundaries are now shown with thin lines using the clip color.
        - A dotted line is shown on a boundary with no fade.
        - A solid line is shown on a boundary that is faded.
        - A gray line is shown in *Track* context for clip boundaries that crop event material.

Group Track superpowers

- Bitwig's powerful Group track workflows have gotten stronger in both function and appearance.
- A summary of the child track's contents is always visible as *meta clips* on the group lane (and as *sub scenes* on the group Launcher slot).

- Audio clips placed on the group lane/slot will override the group track's master output for the duration of those clips. So:
    - You can select meta clips (or make a time selection in the group lane) and then *Bounce in Place* to capture the group output without altering the children.
    - When meta clips are selected, most editing functions (*Transpose*, *Quantize*, *Auto-Fade*, etc.) are applied to the child tracks' clips.
    - Note clips are sent to the group tracks chain, but otherwise allow audio to play normally.
- On the **Arranger Timeline**:
    - Interactive *meta clips* are shown on the group track lane. They are placed into blocks where child clip's line up.
        - Their header color is a blend of the present child clips, relative to their lengths.
- In the **Clip Launcher**:
    - A special *sub scene* is always available, for triggering all slots within that group.
    - When the clip height is tall enough, a visualization of the present child clips is shown just below the sub scene, in the clip slot.
        - In the **Arranger Timeline Panel** view, the clip slot also has its own *Stop clip* and *Return playback to Arranger Timeline* buttons, which apply only to the group's child tracks.
- The project navigation menu has been improved:
    - Whenever a group track is preset in a project, this menu appears in the top-left of the **Arranger Timeline Panel** and any **Mixer Panel**.

    - This provides a way to navigate thru out the hierarchy of the project, focusing at any group level.
    - When within a group track, the child tracks are show at top with the group master shown on bottom.
    - The icon and name of the current level are always shown on screen now in the same menu space, shifting other icons to the right when necessary.
- (The older group-track toggle to either *Show Master Track Content* or *Show Group Track Content* has been removed, as now both are shown.)

Bringing It All Together

- For all editing cases:
    - Selecting any clip will show that clip's contents (whether note, audio, or automation) in the **Detail Editor Panel**.
    - Selecting any track will show its primary content in the **Detail Editor Panel**.
    - For note and audio clips, the lower *Automation Lane* [A] area can show any single automation lane, with a "flying" behavior of following the last clicked parameter.
- When multiple clips/tracks are selected, all selected clips will be loaded in the **Detail Editor Panel**:
    - By default, notes are colored by *Clip* in this mode.
    - The header of the window shows the available clip headers.
    - All clip headers are slightly dimmed, except for the target clip (where new notes will be inserted):
        - Clicking a dim clip header makes it the target clip.

        - Selecting/editing notes also switches the target clip.
    - For the target clip/layer, background areas of the editor are painted with the clip's color to show its current bounds.
    - When both note and audio clips are selected, the *Drum/Hybrid Editor* is loaded to show both types together.
- When working with multiple clips, additional options may appear:
    - A filter toggle is available directly in the panel (below the `Clip`, `Track` context buttons).
    - Clicking the filter toggles the *Edit only selected layers* option and exposes the *Layer List*, letting you clearly switch the focused clip/track.
        - When lanes can be shared (like *Piano Roll Editor* or *Drum/Hybrid Editor*), the current target layer will appear in focus with the other layers dimmed.
        - When in discrete lane modes (like *Waveform Editor* or *Automation Editor*), only the selected layer will be shown.
    - Clicking the header area beside the filter icon opens a menu with additional options, depending on your material and editor
        - The *Editor Timeline* setting, determining the timebase and events shown:
            - `Global Arranger/Launcher Time` shows all clips against the project timeline, and only shows events within the clip bounds.
            - `Clip Content Time (aligned to play start)` lines up clips from their set start times, and shows all clip events.

        - `Clip Content Time (ignoring play start)` lines up clips from their internal `1.1` position, and shows all clip events.
    - The *Layer Grouping* setting, offering different ways to group the layers being shown:
        - `by Note Lane` shows the minimum number of lanes, with one note lane for each used pitch and audio grouped by track.
        - `by Track` shows one lane for each audio track, and one group of note lanes for each instrument track.
        - `by Clip` shows one lane (or group of note lanes) for each clip.
    - These options are also available within the *Editor Settings* menu in a *Layered Editing* submenu.
- Selecting a Launcher scene when the **Detail Editor Panel** is open displays all contents of that scene together.
- Selecting an Arranger cue marker when the **Detail Editor Panel** is open (and in *Track* context mode) displays all contents of the Arranger together, focusing on the selected cue marker.

Spray Can tool

- The Pencil tool makes single events, and the Spray Can paints multiple events.
- In the **Arranger Timeline Panel**, clicking the Spray Can tool creates a looping clip.

    - Clicking and dragging extends the new clip with additional loop iterations.
- When working with notes in the **Detail Editor Panel**, clicking and dragging the Spray Can tool creates a series of notes at the current beat grid interval (read: hi-hats).
    - Dragging up or down adjusts the velocity of new all notes.
    - Holding [ALT] while dragging the Spray Can tool works the same, except dragging up and down can move each step to a different note (read: step sequencing).
    - In the *Piano Roll Editor* with *Snap to Key* enabled (either by clicking the sharp–flat icon or pressing [K]), only in-key notes will preview and be created.
    - Clicking on an existing note erases that note (just as the Pencil tool does).
    - When working with clips or notes, hovering with the Spray Can (and Pencil) tool previews the first object it will create.
- When editing automation, the Spray Can tool draws stepped automation at the current beat grid interval (read: techno).
    - [ALT]-dragging with Spray Can creates a single, flat automation segment for the full length of your drag, for an easy way to create alternating rhythms or longer holds.
    - Each point created uses the *Hold* behavior.
    - This also works for drawing expressions, when using the lane-based *Drum/Hybrid Editor* with *Expression Overlay* mode (or the*Waveform Editor*)
- When working with notes, the Spray Can tool can be used to draw velocity ramps, etc., for successive notes

- This is available with notes in the lower *Note Expression Lane* [V] for any non-continuous expression (*Velocity*, *Release Velocity*, and *Chance*).
- Once you click with the Spray Can tool (showing a pointed crosshair cursor in this area), dragging the mouse will show a line and preview all note expressions to land on this line.
- When you are happy with the previewed result, you can either click and release to commit the events. Or you can click and drag up or down, to bend the shape.

Step Input tool

- When the **Detail Editor Panel** is showing a note clip, the Step Input tool is available for entering notes at the current beat grid interval with MIDI.
- When using the Step Input tool, a glowing white line (not unlike a laser sword) appears, showing the current insertion point. Click at the desired location to place this laser sword.
- The right arrow key [→] moved the insertion point to the next step.
- When a key is played, the note will be previewed on screen.
  - To commit the note at the current length: release the key.
  - To make the note longer: press [→] as many times as you like.
    - The first press commits the previewed note and moves the insertion point to the next step; all subsequent presses of [→] lengthen the note.
  - To insert a rest: press [→] while no MIDI keys are being held.
- These rules work for polyphonic note entry as well. For example:

        - As long as at least one key is being held, the insertion point remains on the current step. Additional notes can be previewed by playing them.
        - Releasing a key in its preview state (while other notes are being held) cancels that one note.
        - If a key is being held when [→] is pressed, that key is now "committed" and will create a note whenever the key is released.
        - Pressing [←] shortens any notes that were being held and moves previewing notes to that point.
            - You can also hold notes and then use [←] to delete as a "musical backspace", shortening or deleting the held notes within that time.
    - When all playing notes are released together, they all end at the same time. This works for simple chords of fixed length, or when committed notes of various lengths are released together.

Audition tool

- Allows previewing any clip or track content by clicking on it.
- When the transport is stopped:
    - Clicking into the Arranger previews that track from the click location.
    - Clicking into the **Detail Editor Panel** previews visible tracks/clips from the click location.
    - Clicking a Launcher clip/scene previews that content from the beginning.

    - On release, the transport is stopped and restored to its state before auditioning.
- When the transport is playing:
    - Clicking into the Arranger previews that track from the current playback position.
    - Clicking into the **Detail Editor Panel** previews visible tracks/ clips from the current playback position.
    - Clicking a Launcher clip/scene previews that content from the calculated playback position.
    - On release, playback continues in its previous state.
- Auditioning works via the program's solo mechanism, so it also supports *Solo as Cue*, when enabled (available in the **Studio Monitoring Panel**, or by right-clicking on any solo button in the mixer).

Clip Launcher Status Displays

- Clip Launcher running status is now nicely visualized on each track.
- The last row of the Clip Launcher visualizes the running status of that track.
- In the vertical **Mixer View**, this appears at bottom. Within the **Arrange View**, this last row is shown on the right.
- When the transport is stopped but the Launcher is in control, a circle is painted here in the active clip's color.
- When the transport is running, the circle is painted over clockwise, indicating the playback position within the current clip.
- If it's a looping clip, a play count will show in the center of the clip, starting on the second play (2).

    - From the 100th clip loop and beyond, the play count attains infinity status (∞).
- When the playing clip has a *Next Action* enabled, the playback indicator is ringed by a blue arc, showing the timer for the action. When the arc is completed, the *Next Action* fires.
- When hovered over, this status display is swapped out for the *Return playback to Arranger Timeline* button for this track.
- When any track's Launcher is active but only the **Arranger Timeline Panel** is on-screen, the Clip Launcher running status is shown on the left edge of the track content area — and still offers the *Return playback to Arranger Timeline* function when clicked.

Circular Modulations

- Most parameters clip when modulated to their maximum (or minimum) values. This is still true.
- A few parameters are more circular, like phase and pitch class. These parameters are no longer clipped, but rather wrap to the other side of the parameter range (from maximum around to minimum, or from minimum value around to maximum).
- In the Interactive Help, each parameter with this behavior shows its range with a *wrapping* modulation annotation.
- Wrapped pitch-class parameters (notes lists from `C` to `B`) include:
    - The *Root Key* transport parameter (when modulated from the project level)
    - **Key Filter+** (Note FX) device's *Local Key* parameter
    - **Key Filter** (Note FX) device's *Key* parameter

    - **Harmonize** (Note FX) device's *Key of Incoming Notes* parameter
    - **Transpose Map** (Note FX) device's *Transform Root* parameter
    - **Pitch Class** (Pitch) module's *Pitch Class* and *Wrapping Key* parameters
    - **Root Key** (I/O) module's *Wrapping Key* parameter
- Wrapped phase and phase-like parameters on devices include:
    - **Chorus** (Modulation) device's *LFO Right Phase Offset* parameter
    - **Freq Shifter+** (Audio FX) device's *Phase* and *Phase Offset (R)* parameters
    - **Freq Split** (Spectral) device's *Split Nudge* and *Split Spin* parameters
    - **Ladder** (Filter) device's *LFO Phase* parameter
    - **Note Repeats** (Note FX) device's *Rotate* parameter
    - **Phase-4** (Synth) device's *R Phase*, *B Phase*, *Y Phase*, and *M Phase* parameters
    - **Ricochet** (Note FX) device's *Room Rotation* and *Ball Launch Angle* parameters
    - **v0 Zap Kick** (Kick) device's *Phase Modulation Target* parameter
- Wrapped phase and phase-like parameters on modulators include:
    - **Classic LFO** (LFO) modulator's *Phase* parameter
    - **Curves** (LFO) modulator's *Phase* parameter
    - **LFO** (LFO) modulator's *Phase* parameter
    - **ParSeq-8** (Sequence) modulator's *Phase Modulation* parameter
    - **Steps** (Sequence) modulator's *Phase Modulation* parameter
    - **Wavetable LFO** (LFO) modulator's *Phase* parameter
- Wrapped phase and phase-like parameters on modules include:
    - **Curves** (LFO) module's *Phase* and *Phase Offset (R)* parameters

- **Freq Shifter+** (Delay/Audio FX) module's *Phase* and *Phase Offset (R)* parameters
- **LFO** (LFO) module's *Phase* and *Phase Offset (R)* parameters
- **Ø Shift** (Phase) module's *Shift* parameter
- **S/H LFO** (Random) module's *Phase* and *Phase Offset (R)* parameters
- **Wavetable LFO** (LFO) module's *Phase* and *Phase Offset (R)* parameters

Touch Screen Improvements

- Touch interactions in the **Arranger Timeline Panel** and the **Detail Editor Panel** now consider which tool is selected:
  - Pointer tool will generally do touch-specific interactions via the **Radial Gesture Menu**.
  - The other, specialized tools now offer the same functionality as when using the mouse.
- A two-finger tap-then-drag gesture offers a new radial menu for switching the active tool.
- Numerous other improvements to timing, target sizes, thresholds, etc.

Project Backups on Update

- When you open a project made in a previous version, the original project file is automatically backed up.

- Within the current project's `auto-backup` folder, a folder called `versions` will be created.
- The backup will use the original project filename, plus the version it was saved with and the last modified date, such as: `Dear Listener \[4.4.8 2023-03-19 223323].bwproject`
- While the top-level backup folder only keeps the ten most recently saved copies, backups in the `versions` folder will not be automatically erased.

General Improvements

- Time scrollbars now display a visual overview of the timeline's content:
  - For the **Detail Editor Panel**, the primary editor determines what is previewed:
    - *Waveform Editor* or *Comping Editor* shows audio.
    - *Piano Roll Editor* shows notes.
    - *Drum/Hybrid Editor* shows notes and audio, if present.
    - *Automation Editor* shows automation curves.
  - For the **Arranger Timeline Panel**, visible Arranger clips are previewed. When present, Arranger cue markers are painted on top and are interactive:
    - [ALT]-clicking a cue marker in the Arranger's time scrollbar will zoom the **Arranger Timeline Panel** to fit the marker's content.
    - [ALT]-double-clicking a cue marker in the Arranger's time scrollbar will trigger playback from that start time.
- Clip Launcher refinements:

- The relative phase of each playing clip is now preserved. (It was working in some cases in previous releases, but with some bugs.)
- For example, if you trigger one Launcher clip and then starting another two bars later:
    - Stopping and starting the transport will resume playback of the clips just as they were originally aligned.
    - If the Arranger play position is moved, clip playback is also moved relatively with the original alignment.
    - **Operators** and seeded *Spread* settings are taken into account, so the current loop iteration will be calculated.
    - When the Arranger loop is enabled, automatic loop jumps do not update Launcher clip positions.
- A new action to *Retrigger playing Launcher clips* is now available:
    - From transport stop, this action retriggers all clips that were playing, thereby re-aligning them from their start.
    - If the transport is playing, this action queues the retrigger using the largest *Main Launch Quantize* setting of the playing clips.
    - Holding [ALT] transforms the Launcher's *Return playback to Arranger Timeline* buttons into clickable *Retrigger playing Launcher clips* buttons.
        - Both project- and track-level actions are available in this case.
    - You can also assign a keyboard or MIDI shortcut to this action.

- Transport automation lanes are at the top of the Arranger now, by the transport section. (These tracks were previously part of the master track.)
  - The transport automation lanes will stay visible on the Arranger, unless you fold the area.
  - Transport parameters include key signature elements (`Root Key` & `Scale`), `Time Signature`, `Tempo`, `Crossfade` position, global `Fill` status, and various global shuffle elements (`Groove on/off`, `Shuffle amount`, `Shuffle rate`, `Accent amount`, `Accent phase`, and `Accent rate`).
  - Each element can be controlled with Arranger automation, or with automation clips (either in the Arranger or on Launcher).
  - Each element can be assigned to a project remotes page.
  - Each element can be modulated with project-level modulators loaded on the master track.
- The `Tempo` lane now has editing settings for the range you want to work in:
  - When the `Tempo` automation lane is shown (available in the upper transport section) or when the **Detail Editor Panel** is focused on `Tempo`, editable axis values are shown to the right of the lane headers.
  - At bottom, the *Minimum Visible Tempo* can be set between `20` and `110` beats per minute (BPM).
  - At top, the *Maximum Visible Tempo* can be set between `110` and `666` beats per minute (BPM).
  - These boundaries are only display parameters. So a new automation point can be dragged to any value, and the *Minimum* and *Maximum* settings will be updated so that all project tempos are always shown.

- Generated names for clips are now more helpful, suggesting where each clip is located:
  - As alias clips share a clip name, clips referencing the same pattern can now appear at various locations.
  - If a clip is used in the Launcher, the generated name uses the first scene number where it is found (e.g., `S4` for scene four, or `S4 +` if the clip also appears in future Launcher scenes).
  - If a clip is used in the Arranger, the generated name uses the first bar number where it is found (e.g., `17` for a clip starting in bar 17, or `17 +` if the clip also appears in future Arranger locations).
  - So an example of a clip appearing in both the Launcher and various Arranger positions could read as: `S4 17 +`.
  - When space is available in the Arranger, clips with generated names will show the track name as well.
  - User provided names will always take priority.
- In the **Arranger Timeline Panel**, hovering with the Pencil and Spray Can tools previews the clip that will be created if you click:
  - Clicking with Pencil tool creates a clip, and dragging will extend its length.
  - Clicking with Spray Can tool creates a looping clip, and dragging will extend its length.
- When using the Knife and Eraser tools in an editor's top ruler area, both tools zoom & pan. Or you can:
  - [ALT]-click with the Knife tool to apply a cut to all tracks/visible events.
  - [ALT]-drag with the Eraser tool to delete the selected area of all tracks/visible events.

- Improved overdub recording behaviors, including for automation cases:
  - When Arranger *Overdub* is enabled (on by default), recording onto the Arranger will add additional notes to passing clips, and new comping takes to existing audio clips.
    - With track automation and automation clips, points will added based on the *Automation Write Mode* (`Latch`, `Touch`, or `Write`).
  - When Launcher *Overdub* is enabled, playing Launcher note clips will add additional notes.
    - Any playing Launcher note/audio clips will also:
      - Record automation to empty slots with a matching clip start time and length.
      - Add automation to existing clips, based on the *Automation Write Mode* (`Latch`, `Touch`, or `Write`).
      - When looping automation clips reach their end, they begin replaying their data on the next loop.
      - All Launcher clips that are overdubbing data show a white plus icon (**+**) where the play or record button normally is.
- Right-clicking the top of the application window offers interactive controls for adjusting the *Midtone* and *Black Level* used thru out the interface.
- Clip headers are now smaller so that content can always be shown (even with tiny slot/lane heights).
  - The text and headers can be adjusted with the *Arranger Clip Header Size* and *Launcher Clip Header Size* settings (in the **Dashboard** under *Settings* > *User Interface* > *View*).

- Mixer channels can now be resized even smaller.
- Arranger clips are now given a light gradient for each loop iteration, letting you see the patterns of your music.
    - Looping clips tint the start of each loop slightly lighter (and the end slightly darker).
    - Dragging the end of the first loop adjusts the *Length* of the looping region.
    - Non-looping clips are shown in their solid color.
- Arranger track headers have been redesigned and improved.
    - In the **Dashboard** under *Settings* > *User Interface* > *View* is a setting for how the *Arranger Volume Control* is represented:
        - When set to `Numeric` (the default), the volume level is shown as a decibel value beneath the record/solo/mute block – or below the panning fader when the track is tall enough to show both. And the volume meter offers an integrated, vertical fader.
        - When set to `Slider`, the volume level is shown as a horizontal slider beneath the record/solo/mute block – with slightly different tinting than panning. And the volume meter is only a meter.
        - When a track is even taller, track input and output choosers will be shown beneath the other controls.
    - As lanes can get smaller than before, headers can flatten to a single line showing essential controls.
    - Track names can now use multiple lines when needed (as can long paths in automation lanes).

    - *Clear VU Meter Peaks & Clipping* [ALT]-[C] can be used to clear the status of all meters. (They are also cleared each time the transport starts.)
    - Default key commands are also provided for *Toggle Track Solo / Cue* [SHIFT]-[S] and *Toggle Track Mute* [SHIFT]-[M].
- Preferences for when to *Move the Play Start Marker* (in the **Dashboard** under *Settings* > *Behavior*) are now improved and more fine:
    - There are separate checkboxes for whether the Play Start Marker should be updated when working on the Arranger, and when working in the **Detail Editor Panel**.
    - When edits *Via the Arranger* are enabled, you can specify whether:
        - `Clips or Time` (the default) selections move the playhead, or
        - `Clips, Time, or Automation Points` selections move the playhead.
    - When edits *Via the Detail Editor Panel* are enabled, you can specify whether:
        - `Time` (the default) selections move the playhead, or
        - `Events or Time` selections move the playhead.
    - Note: the **Detail Editor Panel** settings only apply when working with Arranger content.
- There is now a preference to *Automatically open new clips in Detail Editor Panel* (on by default), under **Dashboard** > *Settings* > *Behavior* > *Defaults*.
- There is now a window option to *Center transport display* (on by default), under **Dashboard** > *Settings* > *User Interface* > *Transport*.

    - Disabling this setting can leave more space for pinned editing actions.
    - You can also right-click within the transport display area to toggle both this setting and the *Show loop region* option.
- The **Browser Panel** now offers visual previews of selected Curve and Wavetable files.
- When a group track is unfolded, child track backgrounds in the Arranger are tinted with the group color.
- Improved audio painting, showing intensity better when zoomed out and stroke consistency better when zoomed in.
- Audio playback now uses short anti-click fades on transport stop.
- Automation playback smoothing has been improved. It is now time-symmetrical, affects a smaller time range, and offers improved anti-click performance.
- The current beat grid interval (used for snapping and other functions) is shown in the scrollbar, and displayed with brackets – like `[1 / 4]` – when *Adaptive Grid* is automatically adjusted as you zoom in and out.

Improvements

- When multiple objects (clips, events, points, etc.) are selected, non-uniform values are indicated more consistently in the **Inspector Panel** with background "hazard" striping.
- Dragging the start or end of Arranger clips now snaps to various content snap points (such as onsets), when snapping is enabled [39023]

- Automation points can now snap to their *Relative* beat position, clip boundaries, and other points [39838]
- For the **Detail Editor Panel** and **Arranger Timeline Panel**, certain key commands are applied to the editor you are hovering over (even if it isn't selected). This includes:
  - Commands to switch tools already focused on the hovered editor:
    - `Pointer tool` [1]
    - `Time Selection tool` [2]
    - `Pencil tool` [3]
    - `Spray Can tool` [4]
    - `Knife tool` [5]
    - `Eraser tool` [6]
    - `Audition tool` [7]
    - `Step Input tool` [8]
  - Other editor commands that work this way now include:
    - *Timeline Snapping* [S]
    - *View follows playhead* [⇧]-[F]
    - *Adaptive Beat Grid* [/]
    - *Larger Beat Grid* [,] (comma)
    - *Larger Beat Grid Subdivision* [ALT]-[,] (comma)
    - *Smaller Beat Grid* [.] (period)
    - *Smaller Beat Grid Subdivision* [ALT]-[.] (period)
    - *Snap to Key* [K]
- **Detail Editor Panel**: Now shows an individual playback position line for editor layers, when appropriate

- Drag and drop logic across the program has been overhauled to automatically support more cases (such as dragging multiple devices or presets from the **Browser Panel** into the **Device Panel**, etc.).
- **Mixer Panel**: Meters of unfolded child chains (such as **Drum Machine**) and layers (like **Instrument Layer** or **FX Selector**) no longer cut off too quickly when the device is not visible [39836]
- A few additional default shortcuts:
  - *Toggle Arranger Loop* function is now [SHIFT]-[L]
  - *Jump to Previous Cue Marker* function is now [SHIFT]-[ALT]-[,] (comma)
  - *Jump to Next Cue Marker* function is now [SHIFT]-[ALT]-[.] (period)
  - Many others are listed thru out this document when their functions are mentioned.
- **Echo** (Note FX) device got some general improvements and new features:
  - Now has a *Transposition Feedback Behavior* setting, for selecting how *Pitch* transposition is handled when it reaches the *Min/Max* edges:
    - `Cycle` (the default and original behavior) jumps back to the original note when it would pass either edge.
    - `Reflect` folds back toward the original note when it would pass either edge.
  - Now has an **Inspector Panel** options to *Kill on Transport Stop* (off by default), to automatically end all notes and echoes whenever the global transport is stopped.
  - Got a lite GUI refresh, including a longer history scope with better low-velocity sensitivity.

- **Note Grid** (The Grid): Now works with the *Voice Stack Solo* option in the **Inspector Panel**:
  - When an individual voice within a stack is soloed, current notes from other voices (created via **Note Out** modules) will be ended, and any CC messages (via **CC Out** modules) will be suspended.
  - Disabling solo for one or all voices within a stack will also restore any currently active notes.
- **Polysynth** (Synth) device: Expanded Device View now has a *Filter Frequency* / *Filter Resonance* XY control (**F**)
- **Drum Machine** (Container) device: When hovering over a drum cell, the note (for example, `B2`) that triggers that drum chain is shown in the window footer.
- Device chain names have been made more consistent:
  - Instruments with a *Note* chain have been renamed *Note FX*, where space allows
  - Audio FX with *Pre*, *Post* chains have been renamed *Pre FX*, *Post FX*
- **Channel Filter**, **Channel Map**, **Echo**, **Latch**, **Micro-pitch**, **Note Delay**, **Note Length**, **Note Receiver**, and **Velocity Curve** (Note FX): Each have device remotes now (for use with connected hardware controllers, etc.)
- **Bend**, **Note Filter**, **Quantize**, and **Strum** (Note FX): Each have improved device remotes for new/missing parameters, etc.
- **Toggle In** and **Toggle Out** (Mix) Grid modules: Active ports are now visualized based on the modulated value
- The tools of the **Curve Editor** now supports temporary switching via number keys, just as the program's editing tools do: [39893]
  - A short press of any shortcut switches to that tool.

    - Holding the shortcut will temporarily switch to that tool, returning to the previous tool when the key is released.
    - The **Curve Editor** is used by various "curve" devices that use interchangeable BWCURVE files, including:
        - **Segments** (Envelope), a modulator & Polymer/Grid module
        - **Curves** (LFO), a modulator & Grid module
        - **Scrawl** (Oscillator), a Polymer/Grid module
        - **Slopes** (Data), a Grid module
        - **Transfer** (Shaper), a Grid module
        - **Keytrack+** (Note-driven), a modulator
- Device help notes have been added for many convert / upgrade options, available by right-clicking these device's headers:
    - **Mid-Side Split** (Container) offers a *Convert to Stereo Split* option.
    - **Stereo Split** (Container) offers a *Convert to Mid-Side Split* option.
    - **FX Layer** (Container) offers *Convert to FX Selector* and *Convert to Instrument Layer* options.
    - **FX Selector** (Container) offers a *Convert to FX Layer* option.
    - **Instrument Layer** (Container) offers *Convert to Instrument Selector* and *Convert to FX Layer* options.
    - **Instrument Selector** (Container) offers a *Convert to Instrument Layer* option.
    - **Note FX Layer** (Container) offers a *Convert to Note FX Selector* option.
    - **Note FX Selector** (Container) offers a *Convert to Note FX Layer* option.

    - **Compressor** (Dynamics) offers an *Upgrade to Compressor+* option.
    - **EQ-2** (EQ) offers *Upgrade to EQ-5* and *Upgrade to EQ+* options.
    - **EQ-5** (EQ) offers an *Upgrade to EQ+* option.
    - **Filter+** (Filter) offers *Convert to Sweep* and *Convert to FX Grid* options.
    - **Sweep** (Filter) offers a *Convert to FX Grid* option.
    - **Key Filter** (Note FX) offers an *Upgrade to Key Filter+* option.
    - **Polymer** (Synth) offers a *Convert to Poly Grid* option.
    - **Poly Grid** (The Grid) offers *Convert to Note Grid* and *Convert to FX Grid* options.
    - **Note Grid** (The Grid) offers *Convert to Poly Grid* and *Convert to FX Grid* options.
    - **FX Grid** (The Grid) offers *Convert to Poly Grid* and *Convert to FX Grid* options.
- Plug-ins: It is now possible to enter automation values when using plug-ins [39379]:
    - For CLAP and VST3, actual parameter values are used.
    - For VST 2, values of `0` to `100 %` are used in the Bitwig interface.
- Linux + ALSA audio: ALSA backend has been overhauled, improved [40981]
- Linux + PipeWire audio:
    - Improved latency reporting [40981]
    - We now forward active project metadata to the PipeWire node's media info
    - We now set additional metadata on audio ports [40960]
- Controller script added for Novation Launch Control 3

- Controller script added for Softube Console 1 Channel / Fader Mk III (with support for 'Direct DAW Control')
- Controller script added for Neuzeit Instruments's Drop
- Controller script added for Akai MPK Mini IV
- Controller script added for A&H Xone:K3
- Controller script for NI Komplete Kontrol Mk3: Plug-in Bypass added
- macOS: Added camera permission to the audio engine, in case plug-ins want to, um, use the camera

Fixes

- Onset sorting has been improved, allowing better filtering when working with the onset *Threshold*
- *Split* is now in Arrange context menus for clip and time selections[40029]
- `Touch` automation mode never creates data beyond the "touch off" event [39087]
- Right-clicking on various objects makes sure the target is selected and the correct context menu is offered [40794]
- Solo no longer includes tracks routed from the output of an actually soloed track [39662]
- **FX Selector** (Container) device: No longer causes volume inconsistencies when in `Round-robin` [40616]
- **FX Grid** (The Grid) device: Voice stack solo (in the **Inspector Panel**) now works for *True Mono* cases as well
- **Phase-4** (Synth) device: Expanded Device View's *Filter Frequency* / *Filter Resonance* XY control (**F**) no longer goes off screen

- **Sampler** (Synth) device: *Envelope Mode* parameter no longer truncates, at some scalings
- **Ring-Mod** (Audio FX) device: Now dims the *Oscillator Frequency* setting when an external signal is being used
- **ParSeq-8** and **Steps** (Sequence) modulators: Now shows the correct active step, even when in *Hold* mode, etc. [39907]
- **Average** (Level) Grid module: No longer resets directly to `0` at note on when polyphonic [40002]
- **Pitch**, **Pitch Scaler** (Pitch) and **Value Readout** (Display) Grid modules: Always display correct octaves now [40367]
- **Inspector Panel**: For Launcher clips, all *Main / ALT* trigger settings on *Use Project Setting* now repaint their icon immediately when the project setting changes
- The notification option for a detected audio device to *Don't Show Again* should work now [40878]
- When doing a *Bounce* directly from clip drag, canceling the bounce (with [ESC]) now deletes the created audio file [41052], [41053]
- MIDI files that contain invalid MIDI messages can now be loaded (with the invalid messages ignored) [40597]
- VST3 plug-ins: Better handling of the restart component [39935]
- Windows ARM: Update notifications now point to the ARM download [38114]
- Controller integration for Derivative Touch Designer: Application performance no longer slows when using certain multi-monitor setups [38234]
- Controller script for Arturia KeyLab Essential Mk3: Minor fixes for quantization focus, track bank selection, and browser selection

- Softube Console 1: Fixed an issue where layers get confused when moving the plug-in [40154, 40156]
- Application no longer freezes when selecting audio input or output for devices… that have at least 1,024 ports [39351]